ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 • (217) 782-2829
PAT QUINN, GOVERNOR LISA BONNETT, DIRECTOR

Project Summary

Construction Permit/PSD Approval - Revision
Dynegy Kendall Energy, LLC
Kendall Energy Center
1401 County Line Road
Minooka, IL 60447

Site Identification No.: 093808AAD
Application No.: 98110017

Schedule
Public Comment Period Begins: November 21, 2014
Public Comment Period Closes: December 21, 2014

Illinois EPA Contacts
Permit Analyst: Shashi Shah
Community Relations Coordinator: Brad Frost
217/698-1849
Brad.frost@illinois.gov

INTRODUCTION

Dynegy Kendall Energy, LLC (Kendall Energy) has requested revisions to the air pollution control construction permit issued for the Kendall Energy Center. The revisions would clarify when different short-term emission limits for certain pollutants apply to the natural gas-fired generating units at this facility. They would also correct errors in these limits that were made during a previous revision of this permit.

The Illinois EPA has reviewed Kendall Energy's request for revisions to this construction permit and made a preliminary determination that it meets applicable requirements for revisions to this permit. The Illinois EPA has prepared a draft of the revised construction permit that it would propose to issue. Before issuing a revised permit, the Illinois EPA is holding a public comment period to receive comments on the proposed issuance of a revised permit and on the proposed changes to the permit, as set forth in the draft of the revised permit.

BACKGROUND

The Kendall Energy Center is a natural gas-fired electric power plant with a nominal capacity of 1200 MW. The facility operates as an "intermediate load" power plant, operating mainly during periods of higher demand for electricity. As such, the operation and utilization of this facility are greater than those of a peaking power plant but lower than those of a base load power plant.

The Kendall Energy Center has four "combined cycle" combustion turbine generating units that burn natural gas. Each unit produces electricity from an electric generator that is powered by the combustion turbine. Each unit also has a heat recovery steam generator following the combustion turbine. The heat recovery steam generator utilizes the hot exhaust discharged from the turbine to make steam. This steam is then sent to a steam turbine that powers another generator to produce additional electricity.[1]

In addition to burning natural gas in the burners of the combustion turbine, each generating unit can also burn natural gas in "duct burners" located in the ductwork between the combustion turbine and the associated heat recovery steam generator. This raises the temperature and amount of heat energy in the flue gas that enters the heat recovery steam generator, increasing the amount of steam that can be sent to the steam turbine generator. At times, some of this additional steam may also be sent back to the combustion turbine to augment the amount of electricity that is produced by the generator powered by the combustion turbine. These modes of operation of a unit, with natural gas being burned in the duct burners, serve to boost the amount of electricity that is generated by the units when more power is needed.

[1] Units that generate electricity using an engine, such as a combustion turbine or a reciprocating engine, and that also recover heat from the exhaust from the engine as steam or hot water are referred to as "combined cycle units." This is because the heat or thermal energy from burning fuel in the unit is recovered for productive use in two ways. As a result, the energy efficiency of combined cycle units is generally higher than units that only recover the thermal energy in one way.

The pollutant of interest for the generating units at the Kendall Energy Center is nitrogen oxides (NOx). NOx is formed during combustion by the combination of nitrogen and oxygen in the air at high temperatures. The level of nitrogen oxide formation is strongly dependent on the peak temperatures and other conditions in the turbine combustors. The turbines at the Kendall Energy Center have low-NOx combustors to reduce the amount of NOx that is formed. Selective catalytic reduction (SCR) systems are also used on the units to control the NOx that is formed, converting most of this NOx back to nitrogen. The effectiveness of these measures depends on operation of the units above minimum load levels. Otherwise, the combustors must operate to maintain stable combustion in a way that forms more NOx. When operating at or below minimum stable load, the temperature in the SCR systems will also be below the minimum operating temperature of the catalyst in these systems so that the use of these emission control systems cannot be initiated. Accordingly, alternative requirements apply to the generating units for NOx emissions during startup and shutdown, when the units operate in a load range where NOx control measures are not fully effective.

Continuous emission monitoring is conducted on each generating unit for NOx. As well as providing emission data that is needed for the various allowance programs for emissions of NOx from utility units, this monitoring serves to confirm proper operation of the control measures for NOx and to verify compliance with applicable emission limits for NOx.

The construction of the Kendall Energy Center was authorized by an air pollution control construction permit issued by the Illinois EPA, Permit 98110017, issued June 2, 1999.[2] This permit has previously been revised twice, first in 2006 and again in 2007.[3, 4]

[2] Permit 98110017 was originally issued to LSP - Kendall Energy, LLC, and this facility was referred to as the Kendall County Generation Facility. The ownership of LSP - Kendall Energy changed and it became Dynegy Kendall Energy LLC in 2007. The name of this facility was subsequently changed and it is now referred to as the Kendall Energy Center.

[3] On August 11, 2006, several revisions were made to Permit 98110017. The NOx emission limit in pounds per hour that applies to a generating unit when the duct burner is used was corrected. Alternative hourly emission limits for carbon monoxide (CO) and volatile organic material (VOM) for a unit when operating at less than 75 percent load were removed. Various provisions that addressed initial operation of units as simple cycle turbines, without heat recovery steam generators, were also removed since the units had not been constructed with this capability. Finally, the permitted emissions of the fuel heater at the facility were reduced because a heater with a smaller capacity had been installed.

On July 12, 2007, several revisions were also made to Permit 98110017. Changes were made to allow periodic tuning of the generating units to be conducted. Periodic tuning of the units improves their normal operation, including their energy efficiency. However, while tuning is being conducted, the NOx emissions of a unit may be higher than allowed for normal operation. Changes were also made to the permit to clarify that operation of generating units with the duct burner and with the duct burner accompanied by steam augmentation to a turbine are considered separate modes of operation, with associated startups and shutdowns.

[4] As a new major source of emissions under the federal rules for Prevention of Significant Deterioration (PSD), 40 CFR 52.21, construction of the Kendall Energy Center also had to be authorized under the PSD rules. Permit 98110017 was a "Construction Permit/PSD Approval" and provided this authorization.

DESCRIPTION OF CURRENT REQUEST

Kendall Energy has requested changes to Permit 98110017 to clarify the applicability of certain short-term emission limits set for the generating units in the permit. The requested changes to the permit do not involve the case-by-case determinations of Best Available Control Technology (BACT) for the generating units made in the permit pursuant to the PSD rules. The requested changes also do not involve the permitted annual emissions of the generating units as originally established when this permit was initially issued.

The requested revisions to the permit involve limits for the emissions of NOx, CO, VOM, particulate (PM and PM_{10}) and sulfur dioxide (SO_2) of the generating units in pounds per million Btu (lbs/mmBtu) and pounds per hour. Different limits apply to a unit depending on whether or not the duct burner is being used. The limits for the units without the duct burners in use are in Table 1A; the limits with duct burners being used are in Table 1B.[5] The requested revisions to Permit 98110017 would generally not change the numerical emission limits contained in Tables 1A and 1B of the permit. Rather the revisions would involve the notes that accompany these emission limits that explain when the limits in these tables would or would not apply and in some cases, set alternative emission limits.

Kendall Energy is seeking these revisions to provide further clarity on the short-term emission limits that apply during the various modes of operation of the units, including startup, shutdown, malfunction and periodic tuning of the units. It is seeking these revisions because the previous revisions to Permit 98110017 make it less clear that some of these short-term limits, which were originally developed for and addressed the typical operation of the units, do not apply during other modes of operation. The circumstances in which these limits in Permit 98110017 are applicable should be clear because these limits will be restated in the Clean Air Act Permit Program (CAAPP) permit for the facility, Permit 03030002. This CAAPP permit is currently in the process of being renewed by the Illinois EPA. In addition, Kendall Energy is also requesting that two emission limits that were improperly altered in a previous revision to Permit 98110017 be corrected.

DISCUSSION

As a general matter, it is appropriate for the Illinois EPA to make revisions to Permit 98110017 to make the circumstances in which the different short-term emission limits apply to the generating units clearer, as requested by Kendall Energy. Additional clarity will facilitate compliance by the Kendall Energy Center and reduce the likelihood of differences in the understanding of these provisions of the permit between Kendall Energy, the Illinois EPA, USEPA and others. Each of the various revisions that were requested by Kendall Energy and the changes that the Illinois EPA is planning to make in response are discussed below. It is also appropriate for the two limits that were incorrectly altered in a previous revision to be corrected.

1. Applicability of Limits in Pounds per Millions Btu (lbs/mmBtu)

[5] Condition 10(a)(i) of Permit 98110017 provides that the emissions of the generating units shall not exceed the limits in Table 1A and 1B in Attachment A of the permit.

(Table 1A Note 1 and Table 1B Note 1)

To clarify the applicability of the limits for the generating units in pounds/millions Btu (lbs/mmBtu) in Tables 1A and 1B of the permit, Kendall Energy sought revised language in the notes that accompany these limits. The language proposed by Kendall Energy in its request would have provided that these limits only apply during "normal operation" of a unit and do not apply during "startup, malfunction, shutdown or periodic tuning." This language would have replaced the language in these notes in the current permit, which provides that these limits apply "in the maximum load range" of a unit.

The Illinois EPA is planning to revise these notes to improve clarity with language that is different than the language proposed by Kendall Energy in its request. The current language in the relevant notes, as stated above, clearly provides that the subject limits only apply while a generating unit is operating in the maximum load range. Accordingly, for pollutants other than NOx (i.e., CO, PM/PM_{10}, VOM and SO_2), the clarification to the permit sought by Kendall Energy can appropriately be provided by inclusion of additional language in the revised permit that clarifies that these limits in pounds/mmBtu do not apply "during startup, shutdown or other operation below the maximum load range." For startup and shutdown, this will simply explicitly recognize that generating units operate below their maximum load range during startup and shutdown.[6] For malfunction, it was concluded that the change to the note initially proposed by Kendall Energy is unnecessary. This is because it is unlikely that a unit can or would continue to operate in the maximum load range in the event of a malfunction.[7] Similarly, for periodic tuning of generating units, the change that was proposed is also unnecessary. For the portion of periodic tuning that could theoretically affect emissions of CO, PM/PM_{10} or VOM, a unit will be operating below its maximum load range so these limits in lbs/mmBtu are not applicable. For the portion of periodic tuning when a unit is operating in its maximum load range, the emission rates of CO, PM/PM_{10} and VOM should be unaffected and the current limits should continue to be applicable. In summary, a minor change to the language of the relevant notes in the permit will provide the additional clarity sought by Kendall Energy with respect to the limits in pounds/mmBtu for CO, PM/PM_{10} and VOM.

For SO_2, the emission rate of the generating unit in pounds/mmBtu is not affected by the mode of operation of the units.[8] Accordingly, the limits for SO_2 in pounds/mmBtu for operation of units in the maximum load range serves to addresses SO_2 emissions under all modes of operation. These limits need not apply when units are operating below the maximum load range. In the revised permit, consistent with the current approach in Permit 98110017, SO_2 should continue to be addressed in the same way as CO, PM/PM_{10} and VOM.

[6] The maximum load range of engines is commonly considered to be operation at which testing of an emission units is normally conducted, i.e., within 10 percent of the maximum design capacity of the unit.
[7] In addition, in its application, Kendall Energy has not shown that it is not appropriate for a generating unit to be subject to the specified limits during a malfunction in the unlikely event that it was able to continue to operate in the maximum load range during such an event.
[8] The emissions of SO_2 from the generating units are a result of the sulfur contained in the natural gas burned in the units. For all practical purposes, SO_2 emissions in pounds/mmBtu are a direct function of the amount of natural gas that is burned in a unit and are independent of the mode of operation.

The circumstances associated with the emission limits in pounds/mmBtu for NOx are similar to those for CO, PM/PM_{10} and VOM but there is another aspect of the permit to consider. Condition 2(b) of Permit 98110017 limits the hourly NOx emissions of the generating units to 4.5 parts per million by volume, dry basis at 15 percent oxygen, except during startup, malfunction, shutdown or periodic tuning as addressed by Condition 3. As such, the NOx limits in lbs/mmBtu in Tables 1A and 1B of the permit are either redundant or are potentially inconsistent with these other requirements of the permit. Moreover, as Conditions 2(a) and 3 of the permit are part of the BACT determination for the generating units, they should take precedence. Accordingly, for NOx, the clarification to the applicability of limits in lbs/mmBtu that is sought by Kendall Energy will be better provided by simply removing those limits from Table 1A and 1B of the permit. The short-term rates of NOx emissions of the generating units will continue to be appropriately addressed by the BACT requirements for emissions of NOx.

2. Applicability of Limits in Pounds per Hour for Operation of a Unit Without the Duct Burner (Table 1A Note 2)

   To clarify the applicability of the limits in pounds/hour (lbs/hr) in Table 1A of the permit, which addresses operation of a unit without the duct burners, Kendall Energy proposed revised language in the note that accompanies these limits. The alternative language proposed by Kendall Energy in its request was as follows:

   > The limit for SO_2 applies at all times. The limits of NOx, CO, PM/PM_{10} and VOM shall apply at all times except during startup, malfunction, shutdown, and periodic tuning (see Conditions 2(b), 3(a) and 3(b)) – during these periods, in lieu of these limits, CO emissions shall not exceed 2000 lbs/hr and PM/PM_{10} and VOM emissions shall not exceed the lbs/hr limits in Table 1B.

   This language would replace the following language in the current note, "Except for the limits for NOx (see Conditions 2(b) and 3), these limits apply at all times."

   The Illinois EPA is planning to revise this note to improve clarity with language that is different than the language proposed by Kendall Energy in its request. As reflected in Kendall Energy's request, different changes are needed to clarify the applicability of the limits in pounds/hour that are set for NOx, CO and VOM in Table 1A. With respect to PM/PM_{10}, the Illinois EPA concluded that the change to the note requested by Kendall Energy is unnecessary and this limit should continue to apply at all times. Changes were not requested for nor are they appropriate for the limit for SO_2, which will also continue to apply at all times.[9]

[9] As discussed, the SO_2 emissions of from the generating units are a result of the sulfur in the natural gas burned in the units. The SO_2 emissions of a unit in pounds/hour directly relate to the amount of natural gas being burned in the unit and are not affected by the unit's mode of operation. Accordingly, the limit in pounds/hour for SO_2 in Table 1A, which was developed from the maximum sulfur content of the natural gas burned in the units and the maximum firing rate of the units, should continue to be applicable at all times.

For NOx, while this note currently provides that the emission limit for NOx in pounds/hour does not apply at all times, the note does not actually identify the circumstances during which this limit does not apply. The note instead refers to the conditions in the permit that address the circumstance for a generating unit in which the primary BACT limit for NOx is not applicable, i.e., Conditions 2(b) and (3). As such, it is reasonable to revise this note to directly identify the circumstances in which the limit for NOx in pounds/hour in Table 1A does not apply to a unit. As already discussed above for the limits in lbs/mmBtu, these circumstances are during startup, shutdown, periodic tuning and malfunction.

For CO and VOM, while this note currently provides that the limits in pounds/hour apply at all times, this is due to a mistake made during a previous revision of the permit. When Permit 98110017 was originally issued in 1999, this note provided that the limits for CO and VOM did not "apply below 75% load" and that "CO and VOM emissions between 50% and 75 % load shall not exceed 541 and 30 lb/hr respectively." This explicitly recognized that the combustion efficiency of generating units is lower when they are below their normal operating range. When Permit 98110017 was revised in 2006, various changes were made to the provisions in the permit, including changes to this note. For CO and VOM, the source indicated that the generating units could also comply with the primary limits, which apply for operation at 75 percent load and high, when operating between 50 and 75 percent load.[10] Therefore, the alternative, secondary limits were not needed for operation between 50 and 75 percent load and they could be removed from the permit. However, the permit was incorrectly revised to indicate that the primary limits for CO and VOM would be applicable at all times, rather than simply at 50 percent load and above. Accordingly, it is appropriate to correct this mistake as now requested by Kendall Energy.

For this correction to this note for CO and VOM, alternative, secondary limits are planned for the generating units for operation below 50 percent load. The emissions of CO and VOM from the generating units are significantly impacted by startup, shutdown and other operation below 50 percent load when the combustors in the turbines cannot operate in low-NOx combustion mode. The proposed secondary limit for CO is 2,000 pounds/hour. In its request for a revised permit, Kendall Energy has submitted an air quality analysis that support this limit, showing that it would not threaten ambient air quality for CO.[11] For VOM, the proposed secondary limit is 35 pounds/hour. This is the limit in pounds/hour for VOM that applies to a unit when using its duct burner. As an emission limit that is already applicable to the units , this limit is also appropriately used as a secondary limit for operation without the duct burner.

---

[10] This was a consequence of selection of turbines manufactured by GE for the facility. For the selected turbines, performance testing had now demonstrated that compliance with the principle limits for CO and VOM when the generating units when operating between 50 and 75 percent load. For CO, the overall result of the various revisions to the permit in 2006 was a decrease of about 1000 tons/year in the permitted annual emissions of the facility.

[11] The original application for the facility included air quality modeling for CO for the startup and shutdown of the generating units using an emission rate of 2,000 pounds/hour for each unit assuming that all units startup or shutdown simultaneously. The resulting hourly CO concentration was 2.7 $mg/m^{3.}$ This concentration is less than 10 percent of the hourly National Ambient Air Quality Standards (NAAQS) for CO, which is 35 ppm or 40 mg/m^3. This concentration is also less than the 8-hour NAAQS for CO, which is 9 ppm or 10 mg/m^3.

For PM/PM_{10}, it is appropriate for this note to continue to provide that the limit in pounds/hour applies at all times. Unlike NOx, CO and VOM, the rates of PM/PM_{10} emissions, in pounds/million Btu, from a generating unit should not be expected to be significantly higher during startup, shutdown, periodic tuning or malfunction.[12] Any increases in the rates of emission of PM/PM_{10} during such periods will be counterbalanced by the fact that a generating unit is operating at reduced load. Actual PM/PM_{10} emissions in pounds/hour, which are the product of the emission rate and the operating rate of a unit, should be within the established limit. This is because this limit was developed based on operation of a generating unit at its rated capacity.

3. Applicability of Limits in Pounds per Hour for Operation of a Unit With the Duct Burner (Table 1B Note 2)

To clarify the applicability of the limits in pounds/hour in Table 1B of the permit, which addresses operation of generating units with their duct burners, Kendall Energy proposed minor revisions to the language in the note that accompanies these limits. The alternative language initially proposed by Kendall Energy was as follows:

> Except for NOx, these limits apply at all times. The limit for NOx shall apply at all times except during startup, malfunction, shutdown, and periodic tuning [see Conditions 2(b), 3(a) and 3(b)].

This language would have replaced the following language in the current note, "Except for the limits for NOx (see Conditions 2(b) and 3), these limits apply at all times."

The Illinois EPA is proposing to revise this note to enhance clarity as generally requested by Kendall Energy. As discussed above, while this note currently provides that the emission limit for NOx in pounds/hour in Table 1B does not apply at all times, it does not actually identify the circumstances during which this limit does not apply. The note instead refers to the conditions in the permit that address the circumstances for a generating unit in which the primary BACT limit for NOx is not applicable. As such, it is reasonable to revise this note to directly state that the limit for NOx in pounds/hour in Table 1B does not apply to a unit during startup, shutdown, periodic tuning and malfunction.

This note would continue to provide that the limits in pounds/hour in Table 1B for other pollutants, i.e., CO, PM/PM_{10}, VOM and SO_2, apply at all times. That is, these other limits are applicable whenever a generating unit is being operated using its duct burner. This would now be stated in a separate sentence at the end of this note.

[12] Kendall Energy has not shown the rates of emissions of PM/PM_{10} of the generating units during startup or shutdown are higher to such a degree that the current limit in pounds/hour in Table 1B may be exceeded during startup or shutdown and is not appropriate during such periods. Kendall Energy also has not shown that malfunctions could occur for generating units whose nature would be such that the emissions PM/PM_{10} in pounds/hour would significantly increase and the unit would still be able to continue to be operated.

DRAFT OF THE REVISED PERMIT

The draft of the revised permit includes changes to the notes accompanying Table 1A and 1B of Permit 98110017, as discussed above. The provisions of this permit that contain the determination of BACT for the Kendall Energy Center and the provisions of the permit that set limits on its annual emissions are not changed.

REQUEST FOR COMMENTS

It is the Illinois EPA's preliminary determination that the planned revisions of Permit 9811017 meet applicable state and federal air pollution control requirements. The Illinois EPA is therefore proposing to issue a revised construction permit for the Kendall Energy Center.

Comments are requested on this proposed action by the Illinois EPA and the planned changes to the permit as reflected in the draft of a revised permit.